

8. TRANSPORTATION MODES, ROUTES, AFFECTED ENVIRONMENT, AND IMPACTS

DOE received many comments stating that the transportation portions of the Draft EIS did not provide sufficient information or analysis, and that the analyses relied on incomplete and outdated information. Commenters concluded, therefore, that the transportation-related analyses were inadequate, and substantively and legally deficient.

DOE believes that the EIS adequately analyzes the environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

For the reasons discussed above, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada. DOE has identified mostly rail as its preferred mode of transportation, both nationally and in the State of Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada.

If the Yucca Mountain site was recommended and approved, at some future date DOE would issue a Record of Decision to select a mode of transportation. If, for example, mostly rail was selected (both nationally and in Nevada), in Nevada DOE would identify a preference for one of the rail corridors in consultation with affected stakeholders, particularly the State of Nevada. In this example, DOE would announce a preferred corridor in the *Federal Register* and other media. No sooner than 30 days after the announcement of a preference, DOE would publish its selection of a rail corridor in a Record of Decision. A similar process would occur in the event DOE selected heavy-haul truck as its mode of transportation in the State of Nevada. Other transportation decisions, such as the selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

Nevertheless, because of the public's interest in transportation in general and in the related information and analyses, the Department has included in this Final EIS descriptive information (for example, Appendix, M, *Supplemental Transportation Information*), and maps and tables that show the analyzed routes and estimated health and safety impacts for each state through which the shipments would pass. Appendix M provides general background information about transportation-related topics, such as transportation operations, cask testing requirements, and emergency response.

DOE has revised the analyses to respond to comments and to reflect new information that has become available since publication of the Draft EIS. For example, as requested by commenters, DOE has analyzed the effects of different mixes of rail and truck shipments and has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data. In addition, new information has led DOE to revise, for instance, the transportation accident analyses to reflect the Nuclear Regulatory Commission document *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000).

Many of the following comments indicate dissatisfaction with the adequacy of the transportation analyses. However, for ease of reading and to facilitate understanding of the Department's responses in this chapter, DOE has elected not to repeat the above response. Rather, the reader is referred to this chapter introduction for additional information.

8 (158)

Comment - 56 Comments Summarized

Commenters stated that spent nuclear fuel and high-level radioactive waste could be transported safely to Yucca Mountain, with negligible radiological impacts to public health and safety and the environment. As evidence for this belief, commenters cited such things as the safe record of nuclear-materials transportation over the past 50 years; stringent shipping regulations; extensive testing and certification of shipping casks; robust cask construction; careful training of drivers; special safety features of trucks; and sophisticated tracking of shipments and communications.

Response

The results of the analyses presented in Chapter 6 and Appendix J of the EIS are consistent with the observations of the commenters.

8 (3801)

Comment - EIS001282 / 0003

The Draft Environmental Impact Statement fails to provide essential details about the modes and routes of transportation of the spent nuclear fuel and high-level radioactive waste. The public deserves full disclosure about the amounts, frequency, and types of materials that would pass through the cities where they live, work, and enjoy recreational activities.

Response

In response to public comments, Appendix J of the EIS has been revised to provide state-by-state maps of routes used in the analysis. These maps contain tables that show the numbers of shipments originating in and passing through each state by mode and provides the impacts from the shipments in each state. These numbers should be considered preliminary, as there are many factors that could cause the modes and routes to change, including waste generator site operations, trading of pickup allocations, selection of a different transportation mode for shipments by the site operator, or recommendation of alternate routes by states and tribes. Impacts in individual states could be different if the actual routes from generator sites to Yucca Mountain are different from those analyzed. However, it is not likely that the total impacts from transportation would be changed significantly or that any particular route connecting an origin/designation pair would present a significant difference in impact from any other.

DOE used two analytical scenarios—mostly legal-weight truck and mostly rail—as the basis for estimating the number of shipments of spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites. DOE selected the scenarios because, about 10 years before the proposed start of operations at the repository, it cannot accurately predict the actual mix of rail and truck shipments (mode) that would occur from the 77 sites. Similarly, routes used in the analysis of transportation impacts are highways and rail lines that DOE anticipates it could use for shipments to the repository. However, at this time, about 10 years before start of operations at the repository, specific routes have not been determined. Until such time as a repository site is approved, specific routes and the number of shipments along those routes cannot be determined. Additional discussion of routing can be found in Section M.3 of the EIS.

8 (3897)

Comment - EIS001286 / 0007

In addition to concerns about packaging degradation, we must raise concerns about degraded fuel. DOE must study the fuel from the Perry plant and other nuclear power plants that have fuel rods leaking radioactivity. According to some scientists, this leaking fuel poses a serious threat to public safety and violates the operating licenses. Although it is a violation of federal regulations and a severe health risk for nuclear plants to continue operating with known fuel damage, the plants continue to operate with leaking reactor cores. This leaking fuel has been attributed to debris fretting or to undetected manufacturing defects—the fuel has pin point holes, bad end cap welds and axial cracks. GE believes that the root cause of the failures is undetected manufacturing defects, possibly exacerbated by the Perry operating practice of using control rod movement rather than flow control for minor power adjustments. What is going to happen when this fuel hits the road? DOE should evaluate fuel for undetected defects.

Response

The EIS does consider the issue of degraded fuel. Fuel with identified leaks would be shipped to the site in disposable canisters that have been sealed at the site of generation. These canisters would be placed directly in the

disposal container (which becomes the waste package after it is filled, sealed and tested) without being opened at the repository.

DOE recognizes that some fuel rods would have undetected flaws and that there might be releases to the interior of the transportation canisters and casks. However, the shipping casks would be sealed during transportation and leaks to the exterior of the cask are highly unlikely. The surface handling facilities at the repository are designed to contain any contamination that might be released during transportation. Chapter 2 and Chapter 4 address surface facility operations and wastes generated from decontamination of canisters used in transportation, as well as the management of wastes from the treatment of water in the fuel handling pools.

Degraded fuel rods should have no impact on transportation in terms of radiation exposures or potential releases of radioactive materials associated with accidents or sabotage.

Finally, the studies of long term performance of the repository do assume some cladding failure at the beginning of the analysis period. This is further discussed in Section K.2.1.4 of the EIS.

The issues raised by the commentator concerning the risks of continued operations of nuclear powerplants with known fuel damage is not a subject of this EIS, nor is it a subject that is under the control of the Department of Energy. Operating commercial nuclear reactor licenses and safety concerns are the purview of the Nuclear Regulatory Commission.

8 (6949)

Comment - EIS000390 / 0003

An adequate environmental review of the proposed repository program must absolutely address the deadly nature of the waste to be shipped and buried, yet DOE barely touches on the radiological risks posed by highly irradiated nuclear fuel. Information on the total activity (in curies) and the surface dose rate (in rems per hour) of the assemblies of irradiated fuel is essential for the assessment of risks posed by the transportation and burial of radioactive waste, yet DOE does not provide such data.

According to the State of Nevada, a typical assembly from a pressurized water reactor will contain, even after 26 years of cooling, 31,000 curies of cesium-137 and 21,000 curies of strontium-90, and is a powerful source of penetrating gamma and neutron radiation. One unshielded assembly would have enough radiation to give a person standing next to it a dose of at least 100 rem per minute. After only two minutes of such exposure, cancer risk would roughly double, and symptoms of radiation sickness would probably appear. Ten minutes exposure would be enough to deliver a speedy but painful death to virtually all people exposed. Furthermore, shipping waste as fresh as five years old to the repository is contemplated, and should therefore have been included in the DEIS as a possible scenario, one which would carry even greater radiological risk.

Response

DOE did not estimate the consequences for persons or the environment that could be exposed to bare spent nuclear fuel outside shipping casks because transportation accidents severe enough to eject spent nuclear fuel from shipping casks are not reasonably foreseeable. Bare spent nuclear fuel assemblies represent a powerful source of penetrating radiation. However, because of its high radiation dose rate, heavy shielding, which can include several feet of water shielding, concrete structural shielding for remote-operated hot cells, or massive metal containers such as shipping casks, is always provided for spent nuclear fuel. During shipment, spent nuclear fuel and high-level radioactive waste would be contained within heavily shielded shipping casks that comply with Nuclear Regulatory Commission (NRC) regulations for performance under normal conditions of transportation and accidents. The shipping casks provide the shielding necessary to reduce the radiation dose rate emitted from the shipping cask to safe levels under both normal and accident conditions. Chapter 6 of the EIS presents DOE estimates of risks and consequences of accidents in transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain using such NRC certified shipping casks. DOE estimated the risks and consequences using information from an NRC study (DIRS 152476-Sprung et al. 2000), which analyzed performance of casks and spent nuclear fuel contents in severe transportation accidents. Although the NRC study evaluated a range of severe accidents, including very unlikely ones that would release radioactive materials from shipping casks, it did not project even the most extreme accidents would eject spent nuclear fuel from a shipping cask where persons or the environment could be directly exposed.

The commenter pointed out that the assumptions used in the EIS for the age and radiological characteristics of spent nuclear fuel in the maximum reasonably foreseeable accident scenarios could understate the transportation risks. It is true that DOE could ship some spent nuclear fuel that is more radioactive than the 26 year-old pressurized water reactor spent nuclear fuel analyzed in the scenario. Based on comments received and DOE's additional review of technical documents and conduct of hazard analyses, the basis for the transportation impact analysis has been revised to consider commercial spent nuclear fuel that has median hazard. Spent nuclear fuel having median hazard would be discharged from a reactor approximately 14 years before shipment to Yucca Mountain. The radionuclide inventories of the representative spent nuclear fuel used in the analysis are presented in Tables A-8 and A-9 of the EIS. If any 5-year old or 10-year old spent nuclear fuel were to be shipped to the repository, it would be a small fraction of the total shipments. This is a case in which "average" data is used in the EIS as opposed to bounding assumptions. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatism, yielding unrealistic results, in analyzing accident scenarios. Other elements of the impact analyses (for example, radiation dose rates, atmospheric dispersion modeling, release fractions) are such that the transportation impact results presented in the EIS are bounding yet not so conservative that the true differences among alternatives are masked.

8 (8491)

Comment - EIS010150 / 0005

Clearly there are other aspects of the Draft Environmental Impact Statement that has changed and will continue to change since the draft was released. Transportation significantly needs to be rewritten, and hearings on this issue need to be held in the communities that would be affected, some of which were not identified by the draft but now are likely to be affected by transportation.

To conclude, from the perspective of public health and safety, these issues should be of serious concern because we do not know at the end of the day, we do not have an assessment of the environmental impacts of the repository proposal.

Response

The Draft EIS discussed ongoing site characterization activities and design evaluations, and the potential for resulting changes to repository design. Since DOE issued the Draft EIS, it has acquired an improved understanding of the interactions of potential repository features with the natural environment, and the advantages of a number of design features (such as titanium drip shields) to enhance waste containment and isolation. DOE issued the Supplement to the Draft EIS to provide the updated information to the public. While aspects of the design have evolved, the basic elements of the Proposed Action to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain (such as transportation of spent nuclear fuel and high-level radioactive waste) remain unchanged. For this reason, the Supplement focused on the most recent design enhancements, including various operating modes to manage heat generated by emplaced spent nuclear fuel and high-level radioactive waste.

Because the Supplement focused primarily on matters involving repository design, the Department held three public hearings in Nevada during the comment period. Commenters nationwide were encouraged to submit comments at public hearings and by mail, facsimile, and the Internet during the comment periods. DOE used means comparable to those used for the Draft EIS (advertisements, releases, announcements) to notify the public.

DOE believes that the EIS adequately analyzes the environmental impacts that could result from either the Proposed Action or the No-Action Alternative. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts that could occur, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist.

8 (9209)

Comment - EIS002140 / 0006

Area 5. We're bringing in nuclear waste like crazy out there. I can remember working in Area 5 when certain shipments came in from submarines, so on and so forth and we couldn't even get near it. When the guys with guns would come out, we'd unload it and bury it in Area 5. It's been going on for years and years. This is -- shipping nuclear waste to Yucca Mountain is not a new thing.

Response

The comment is correct that the Nevada Test Site is a disposal site for low-level radioactive waste from around the DOE complex, and will continue to fulfill that role in the future. Chapter 8 of the EIS discusses how impacts from these disposal activities could contribute to cumulative impacts related to the proposed repository at Yucca Mountain.

The *Final Waste Management Programmatic Environmental Impact Statement For Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DIRS 101816-DOE 1997) and the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996) and their respective Records of Decision describe low-level radioactive waste disposal at the Nevada Test Site.

8 (9662)

Comment - EIS002074 / 0007

With respect to transportation, too, I might also add that the maps that were given out in the handouts today and also the maps that are inclusive in the EIS, they clearly illustrate county boundaries and state boundaries, but they don't illustrate tribal boundaries. And so we may recommend that the maps be expanded, especially due to the special relationships and recognition that's given, that are afforded to tribes, that those boundaries be indicated in there as well as to give a clear and concise picture.

Response

In response to public comments, DOE has revised Appendix J of the EIS to include maps of the rail and truck routes, the number of shipments, and the impacts for each state through which spent nuclear fuel and high-level radioactive waste shipments was analyzed. These are estimates used for analyzing transportation impacts; the actual routes and number of shipments made through a state could be different depending on the routes actually. Native American lands within each state are indicated on both the state transportation maps in Appendix J and on the national transportation maps used throughout the EIS.

8 (10992)

Comment - EIS001952 / 0006

PUCO's [Public Utilities Commission of Ohio] transportation director has also just described the planning, strategy sessions, and citizens surveys for future land use and zoning currently being implemented (from 600 residents of Brown County selected from voter registration records). PUCO has issued grant which Ohio State University (OSU) is currently implementing. The implementation phase currently in progress Brown County most certainly indicates that transportation routing decisions have, in fact, already been made. Full participation by the public, as described by PUCO, appears to be re-invented as meetings to which the public is invited where questions and/or objections may be stated after-the-fact and too late to do any good.

Response

In the context of the letter that included this comment, the commenter is describing the actions of the Public Utilities Commission of Ohio in relation to the routing of spent nuclear fuel and high-level radioactive waste shipments through Brown County, Ohio, to the proposed repository at Yucca Mountain. Section 6.2 of the EIS discusses the transportation of these materials from the 77 generator sites to the State of Nevada.

The comment mentions public participation "as described by PUCO." Typically, the Department of Energy uses Federal publications (for example, the *Federal Register*) and public media (for example, newspapers, web sites, and radio and television stations). Individuals and organizations can add their names to the DOE mailing list to receive notifications of information availability and upcoming events. DOE has no control over how or when other organizations choose to notify their stakeholders.

8 (12090)

Comment - EIS002307 / 0004

Section 6 of the DEIS is incorrect in the evaluation of transportation risks because the DEIS uses outdated models (RISKIND and RADTRAN4) to compute the risk factors.

Response

The RISKIND code has been used widely and is generally accepted as appropriate for estimating the consequences of transportation accidents that could release radioactive materials. RADTRAN 5 was used for the analyses in the Final EIS.

8 (12273)

Comment - EIS010096 / 0017

Figure 2-4 of the SUPPLEMENT TO THE DRAFT EIS refers only to direct rail access and heavy-haul access to the site. The text on Page 2-12 refers to legal-weight trucks. It is not clear if DOE anticipates legal-weight trucks being used to transport waste directly to the Yucca Mountain site.

Response

Even though DOE has expressed a preference for rail, both nationally and in Nevada, the repository design would facilitate the ability to receive spent nuclear fuel or high-level radioactive waste delivered by legal-weight truck.

8 (12415)

Comment - EIS010279 / 0004

Although transportation issues were not discussed in the Supplement to the Draft EIS, the DOE recently informed the Timbisha Shoshone Tribe that the proposed *Carlin/Caliente Bonnie Claire Option* for a rail corridor to Yucca Mountain goes right through the Scottys Junction Trust Parcel of the Tribe (see attached map). Let it be on record that the Timbisha Shoshone Tribe strongly opposes this proposed rail corridor because of its potential threat to the land, the safety of tribal members, and the adverse effects it would have on the Tribe's economic development. The inadequate, small scale map in the DEIS (p. 6-42) did not show this occurrence even though *The Timbisha Shoshone Tribal Homeland: A Draft Secretarial Report to Congress to Establish a Permanent Tribal Land Base and Related Cooperative Activities* indicated the location of the proposed Trust land parcel (p. 35) and was published in April 1999, three months before the publication of the DEIS for Yucca Mountain.

Response

The Department acknowledges the Timbisha Shoshone Tribe's opposition to the Bonnie Claire option of the Carlin and Caliente Corridors. At this time, DOE has not identified a preference for a specific rail corridor within Nevada. DOE would identify a preferred corridor only if the Yucca Mountain site were approved under the NWPA, and then only after consultation with affected stakeholders, particularly the Timbisha Shoshone Tribe.

Section J.3.1.3 of the EIS contains a discussion of the land-use conflicts with each of the evaluated rail corridors, including the Bonnie Clare Alternate. Detailed corridor maps included in this section show the Timbisha Shoshone Trust Lands and the proposed alignment.

8.1 General Opposition to Transporting Spent Nuclear Fuel and High-Level Radioactive Waste

8.1 (170)

Comment - 589 comments summarized

Commenters stated their opposition to the transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain by rail, heavy-haul truck, or legal-weight truck. In many cases, reasons for the opposition were not specified or were very broad in scope. Examples include broad, nonspecific impacts to the environment and ecosystem; generic accidents with catastrophic consequences; incidental and cumulative radiation exposure to millions of people along the transport routes during decades of transport; sabotage and terrorist attacks; and natural disasters.

Many commenters expressed opposition to spent nuclear fuel and high-level radioactive waste transport through specific neighborhoods, cities, heavily populated areas, specific states, and other areas. Reasons for the opposition included the proximity of potential routes to specific structures and areas such as private residences, schools, hospitals, lakes, rivers, and Native American tribal lands. Some commenters stated that the EIS does not provide adequate detail regarding transportation risks along designated nationwide routes and specific cities and communities. Others were opposed because of the disproportionate share of shipments that would travel through a